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| 10/658,460      | 09/10/2003  | Myounggoo Lee        | 029567-00004        | 2221             |

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| 7590                                   | 02/04/2008 |
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|                        |  |
|------------------------|--|
| EXAMINER               |  |
| MCDONALD, RODNEY GLENN |  |

|          |              |
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| ART UNIT | PAPER NUMBER |
| 1795     |              |

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| MAIL DATE  | DELIVERY MODE |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/658,460             | LEE ET AL.          |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Rodney G. McDonald     | 1795                |  |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 November 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 5 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Miyoshi et al. (07-018431).

Regarding claim 5, Miyoshi et al. teach a bias sputtering film forming apparatus comprising an AC power source of variable output against a substrate electrode and a database stored in a control system. The control system sets a cathode voltage to a predetermined value, stores a substrate bias voltage value in the database when the substrate electrode is apart from a target by a predetermined distance and the thickness distribution of thin films on a surface of the substrate electrode corresponding to the substrate bias voltage value as reference data, and controls the out put of the power source such that the output is progressively varied based on bias voltage functions produced by selecting a substrate bias voltage value from the database, which renders the film thickness substantially uniform when the surface is formed. (See Abstract; Example Japanese Translation)

Regarding claim 6, Miyoshi et al. teach an apparatus further comprising a power source of variable output against the cathode, wherein the control system also varies the cathode voltage by controlling the output of the cathode power source, and the bias

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sputtering film forming is performed by controlling the output of the substrate power source based on the bias voltage functions. (See Abstract; Example Japanese Translation)

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iacoponi et al. (U.S. Pat. 6,261,946) in view of Ikeda (Japan 63-278252) and Miyoshi et al. (Japan 07-018431).

Regarding claim 1, Iacoponi et al. teach a bias sputtering film forming process for forming a thin film by applying both voltages of a cathode voltage and a substrate bias voltage. (Column 7 lines 51-67; Column 8 lines 1-21) A thin film is formed on a

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substrate whereon an irregularity is formed in the state wherein only the cathode voltage is applied. (Column 5 lines 39-41; Column 2 lines 35-44; Column 6 lines 19-23) Sputtering film forming is performed while progressively varying the substrate bias voltage so that the thickness of the thin film formed on the internal surfaces of the irregularity is substantially uniform. (Column 7 lines 66-68; Column 8 lines 1-14; Column 5 lines 42-68; Column 6 lines 1-3)

Regarding claim 3, Iacoponi et al. teach the sputtering particles coming from the target enter substantially vertically in the substrate due to the applied bias. (Column 8 lines 5-14)

Regarding claim 4, Iacoponi et al. teach the layer can be used as a seed layer for subsequent electroplating. (Column 6 lines 4-11)

The differences between Iacoponi et al. and the present claims is that where the increasing is a gradually increasing (Claim 1), wherein the progressively varying substrate bias voltage corresponds to stored substrate bias voltage values in a database stored in a control system (Claim 1),

Regarding where the increasing is a gradually increasing (Claim 1), Ikeda teaches a process where a film is formed with excellent step coverage. The film is formed by gradually increasing the power of a high-frequency bias during a sputtering process. When a sputtering process is executed while the power of a high-frequency bias is lowered, a metal is applied sufficiently to the bottom of a semiconductor substrate without damaging the semiconductor substrate. Then, the power of the high-frequency

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bias is increased, and a metal film 3 whose step coverage at a stepped part is excellent is formed. (See Abstract)

The motivation for gradually increasing the bias voltage is that it allows forming uniform films over stepped surfaces. (See Abstract)

Regarding wherein the progressively varying substrate bias voltage corresponds to stored substrate bias voltage values in a database stored in a control system (Claim 1), Miyoshi et al. teach a programmable controller 8 coupled to power sources for the target and substrate for controlling the biases to the target and the substrate. (See Abstract)

The motivation for utilizing a controller is that it allows controlling the substrate bias. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Iacoponi et al. with the features of Ikeda and Miyoshi et al. because it allows for controlling substrate bias to deposit films with good step coverage.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iacoponi et al. in view of Ikeda and Miyoshi et al. as applied to claims 1, 3 and 4 above, and further in view of Mamoru (Japan 2000-096223).

The difference not yet discussed is where the cathode voltage is also varied, and the bias sputtering film forming is performed while varying the substrate bias voltage. (Claim 2).

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Regarding claim 2, Mamoru teach controlling the DC bias to the target during deposition. (See Mamoru Abstract) Miyoshi et al. discussed above teach controlling the substrate bias and the DC bias at the same time. (See Miyoshi et al. discussed above)

The motivation for utilizing the features of Mamoru is that it allows for preventing disconnecting of the film layer. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Mamoru because it allows for preventing disconnection of the film layer.

### ***Response to Arguments***

Applicant's arguments filed November 13, 2007 have been fully considered but they are not persuasive.

In response to the argument that Miyoshi fails to teach varying the bias voltage with respect to voltage values stored in a database, it is argued that Miyoshi's programmable controller can be considered to be a database with values of bias voltage. The programming aspect would store values of voltages. The voltages change over time. (See Miyoshi et al. discussed above)

In response to the argument that Miyoshi fails to teach voltage values stored in a database are stored with respect to a distance between the target and the electrode, it is argued that Miyoshi teach voltages stored in a programmable controller which is considered to be a database. The distance between the target and the electrode is fixed and is thus the predetermined distance. As film formation changes overtime due



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to the fixed distance between the target and the substrate Miyoshi suggest varying the voltage in order to achieve a uniform film. (See Miyoshi discussed above)

In response to the argument that Miyoshi varies the bias voltage on the basis of film thickness and not on the basis of distance between the target and electrode, it is argued that Miyoshi teach voltages stored in a programmable controller which is considered to be a database. The distance between the target and the electrode is fixed and is thus the predetermined distance. As film formation changes overtime due to the fixed distance between the target and the substrate Miyoshi suggest varying the voltage in order to achieve a uniform film. (See Miyoshi discussed above)

In response to the argument that Iacoponi et al. fails to teach forming a thin film whereon an irregularity is formed in the state wherein "only" the cathode voltage is applied, it is argued that Iacoponi et al. teach forming an initial barrier film and then forming a seed layer of copper. The initial barrier film is formed by a process such as physical vapor deposition (i.e. sputtering) which necessarily requires a bias applied to the cathode. As one considers sputtering there can be from this group selected sputtering and bias sputtering. Selection of sputtering would require only cathode voltage application. (See Iacoponi et al. discussed above)

In response to the argument that Iacoponi et al. does not teach sputtering film forming performed while progressively varying the substrate bias voltage so that the thickness of the thin film formed is substantially uniform, wherein the progressively varying substrate bias voltage corresponds to stored substrate bias voltage values in a database stored in a control system, it is argued that Iacoponi et al. teach sputtering the



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seed layer by varying the substrate bias voltage from an initial value to a higher value. Both Ikeda and Miyohsi et al. suggest varying the bias voltage progressively to produce film layers. (See Iacoponi et al., Ikeda and Miyoshi et al. discussed above)

In response to the argument that Miyoshi et al. fail to teach any database that stores a plurality of substrate bias voltage values, it is argued that Miyoshi et al. teach a programmable controller that can be considered to be a database with values of bias voltage. The programming aspect would store values of voltages. The voltages change over time. (See Miyoshi et al. discussed above)

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

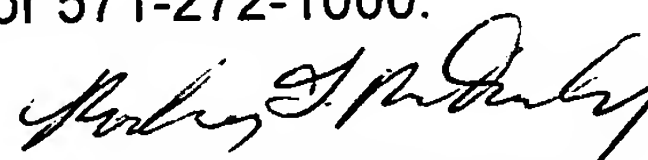
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M-Th with every Friday off..

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Rodney G. McDonald  
Primary Examiner  
Art Unit 1795

RM

January 30, 2008